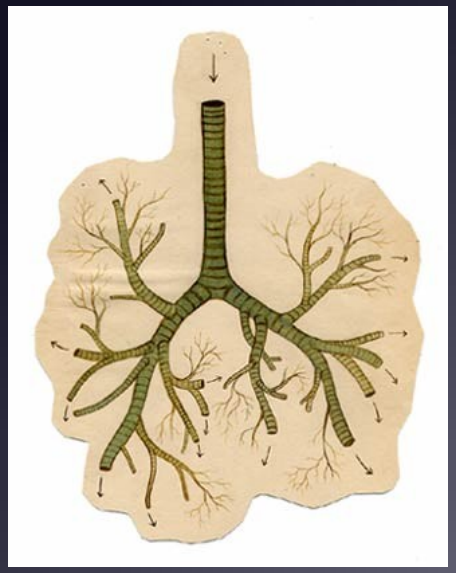
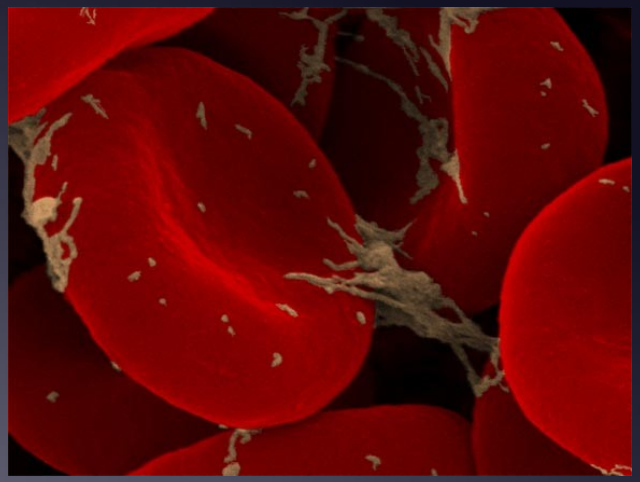
Cardiovascular Wellness





Presentation Outline

I. Introduction to the cardiovascular system
   a) Heart
   b) Blood vessels
   c) Blood

II. Cardiovascular system health

III. Exercise for cardiovascular health

Cardiovascular disease is the leading cause of death in the United States.

Physical activity is one of the best things you can do to **help prevent a heart attack** and stroke.

Other things include: not smoking, limiting alcohol use, managing stress, maintaining a healthy body weight and controlling sugar intake.

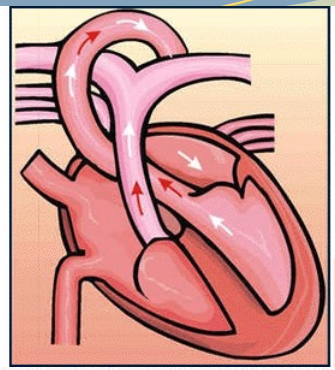
Cardiovascular System Overview

I. Cardiovascular system

Functions

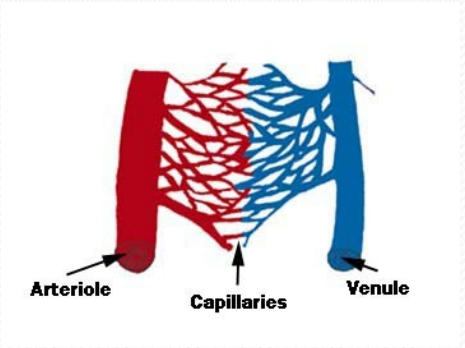
1. Delivery of oxygen and nutrients
2. Removal of carbon dioxide and other waste products
3. Transportation of hormones
4. Maintenance of body pH and body temperature
5. Works to prevent of dehydration and to prevent/fight infections

Three mechanism



- The Heart…the pump

- The blood vessels….the channels



- The blood….the medium

THE HEART

- Myocardium: Cardiac muscle
- Cardiac muscle has some similarities and differences to skeletal muscle.
- Similarities:
  - The heart muscle needs a supply of oxygen and nutrients just like skeletal muscles.
  - The left ventricle is the most powerful part of the heart since it must pump the blood to the entire body. As a result, the myocardium in this chamber is thicker than the others. When demands are high, such as in exercise, the left ventricle increases it’s size.

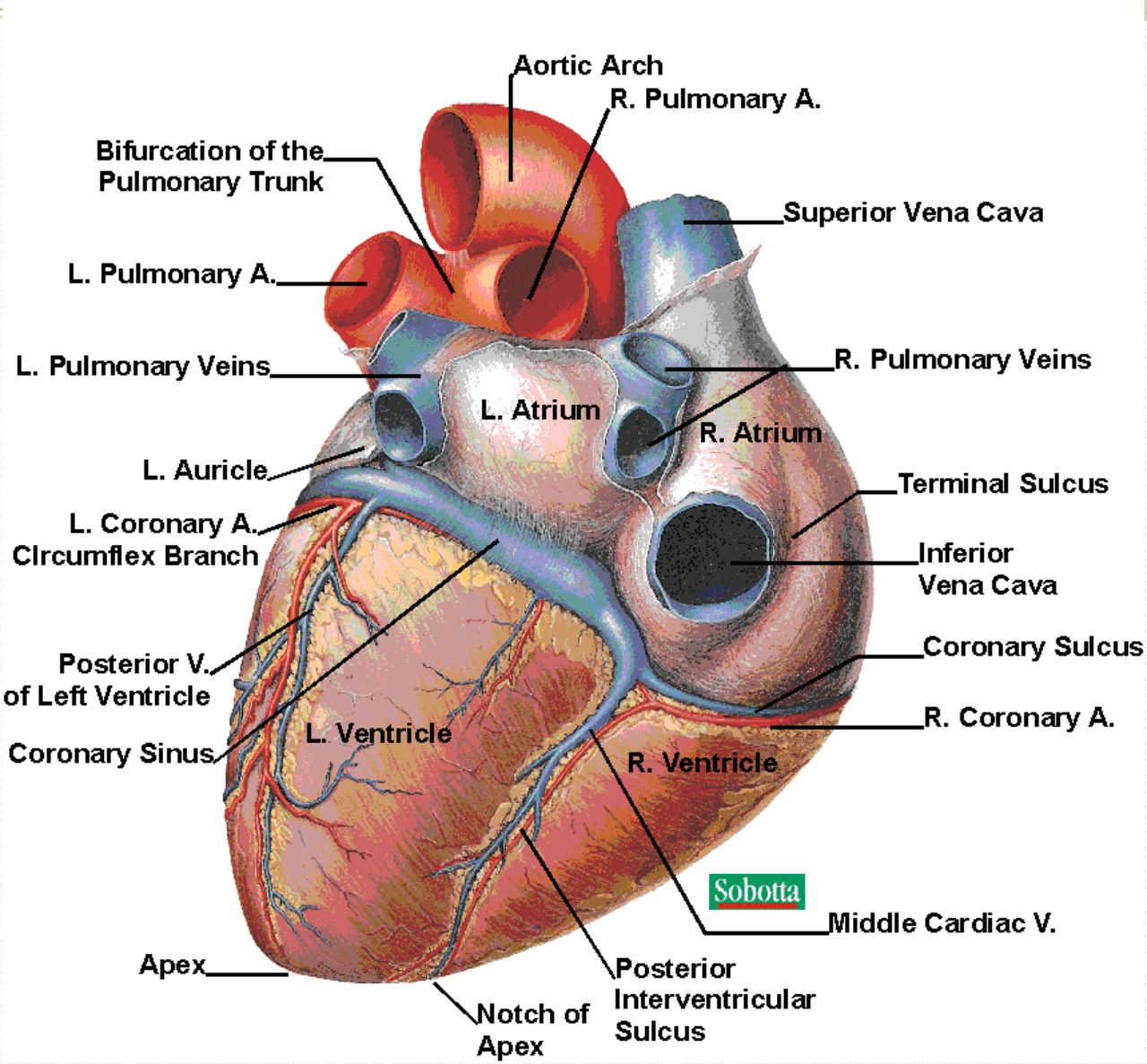
The Heart

- Arteries and veins supply blood (oxygen and nutrients) to the heart.

- If blood flow is interrupted to the heart, the heart may spasm. If part of the heart muscle is without oxygen, it will become damaged and part of the heart can die decreasing it’s ability to function.

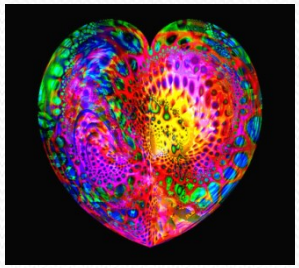
THE HEART

Exterior view

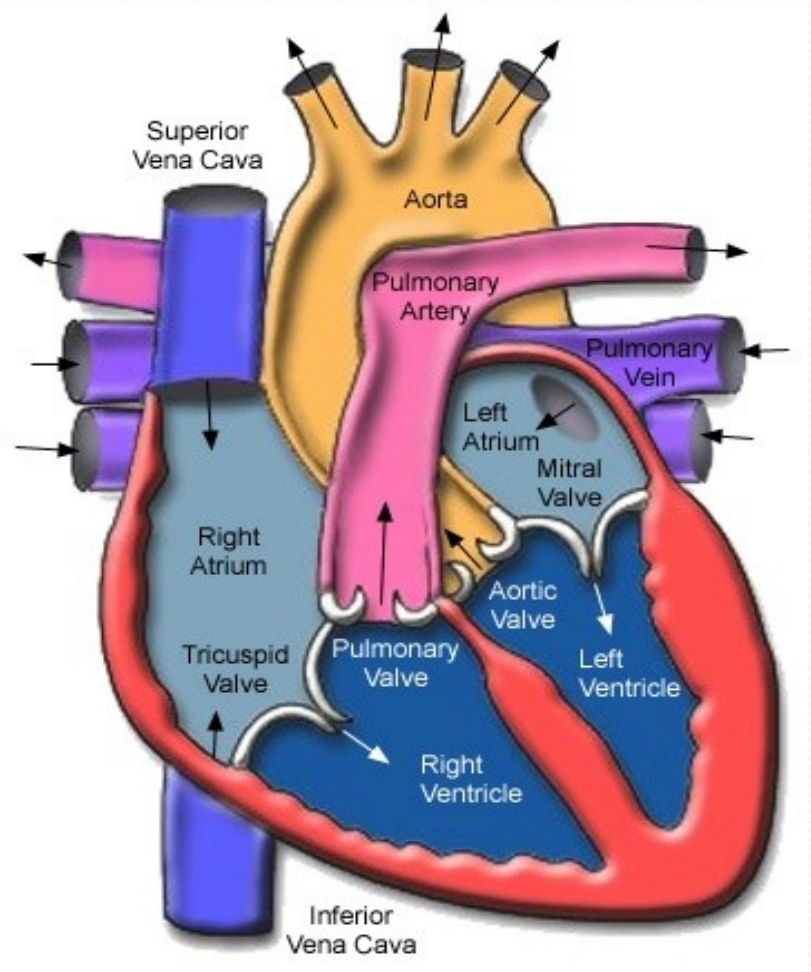


THE HEART: interior overview

- Two atria on top: left and right
- Two ventricles on bottom: left and right
- Four valves
- Arteries and veins coming into the chambers



THE HEART: interior view



THE HEART

- How does the heart muscle contract?

- The heart can generate it's own electrical impulse (autoconduction) so it can contract on it's own without any external stimulation.

- Average resting rate without external stimulation:
  - 70-80 bpm sedentary individual
  - 50-70 bpm aerobically trained individual

Heart function

- **Stroke Volume** (SV): The amount of blood pumped out of the heart during one stroke of contraction (systole).
- The average SV at rest is about 60-80 ml of blood in most adults.
- During exercise in trained individuals stroke volume can be 200ml of blood.

Heart function

- Cardiac Output (Q): The total amount of blood pumped out by the left ventricle in one minute. It is the number of times the heart beats in a minute multiplied by the stroke volume.
- Q = HR X SV

- On average, the adult body contains about 5 L of blood

- If Resting heart rate (RHR) is 60 bpm and the SV about 70 ml…

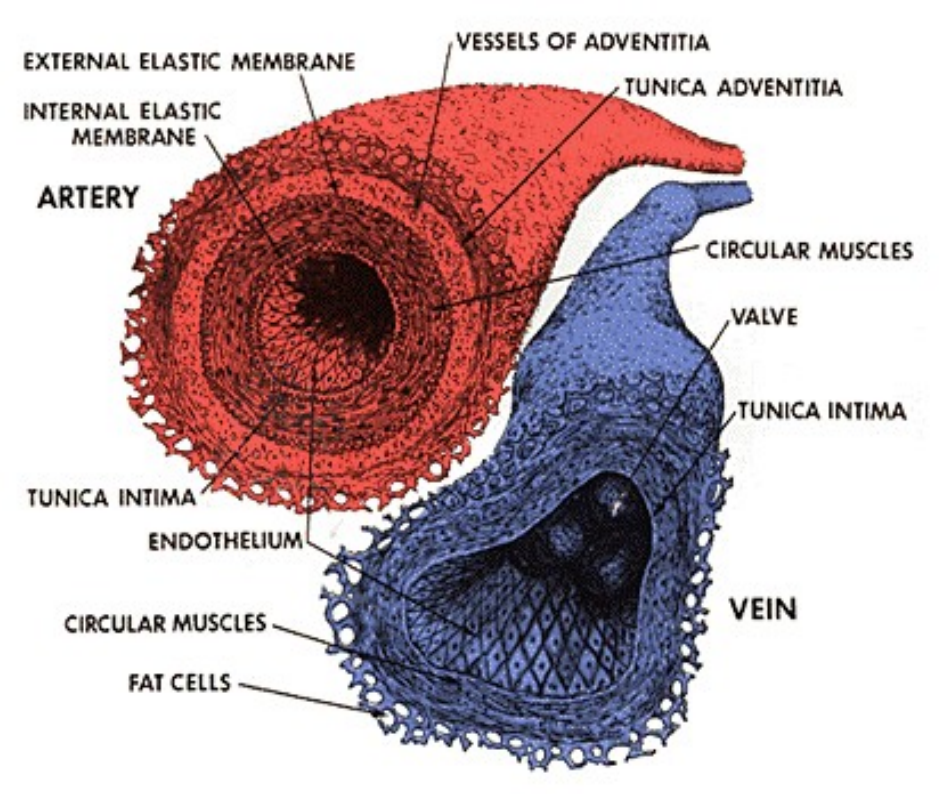
  Q is 4200ml or 4.2 L/min. (average is 4.2-5.6 L/min at rest…

The vascular system

A series of hollow tubes in which the blood travels

- arteries:
- arterioles
- capillaries
- venules
- veins

If you stretched out all the blood vessels in an adult, it could reach 100,000 miles long

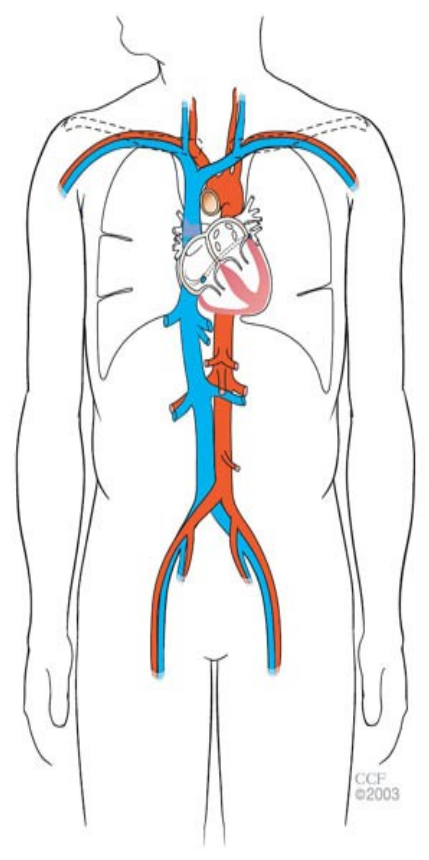


The vascular system

- **arteries: large elastic vessels that take blood away from the heart.**
- **arterioles: smaller vessels which carry the blood from larger arteries to the capillaries.**

- **capillaries: the smallest thinnest vessels where oxygen exchange occurs.**
- **venules: oxygen depleted blood travels back toward the heart in these vessels.**
- **veins: larger vessels which carry the blood back to the heart.**

BLOOD FLOW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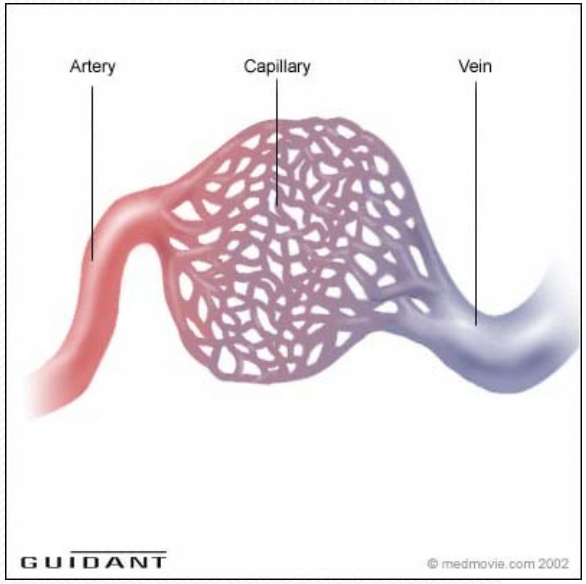
Artery
Capillary
Vein
GUIDANT
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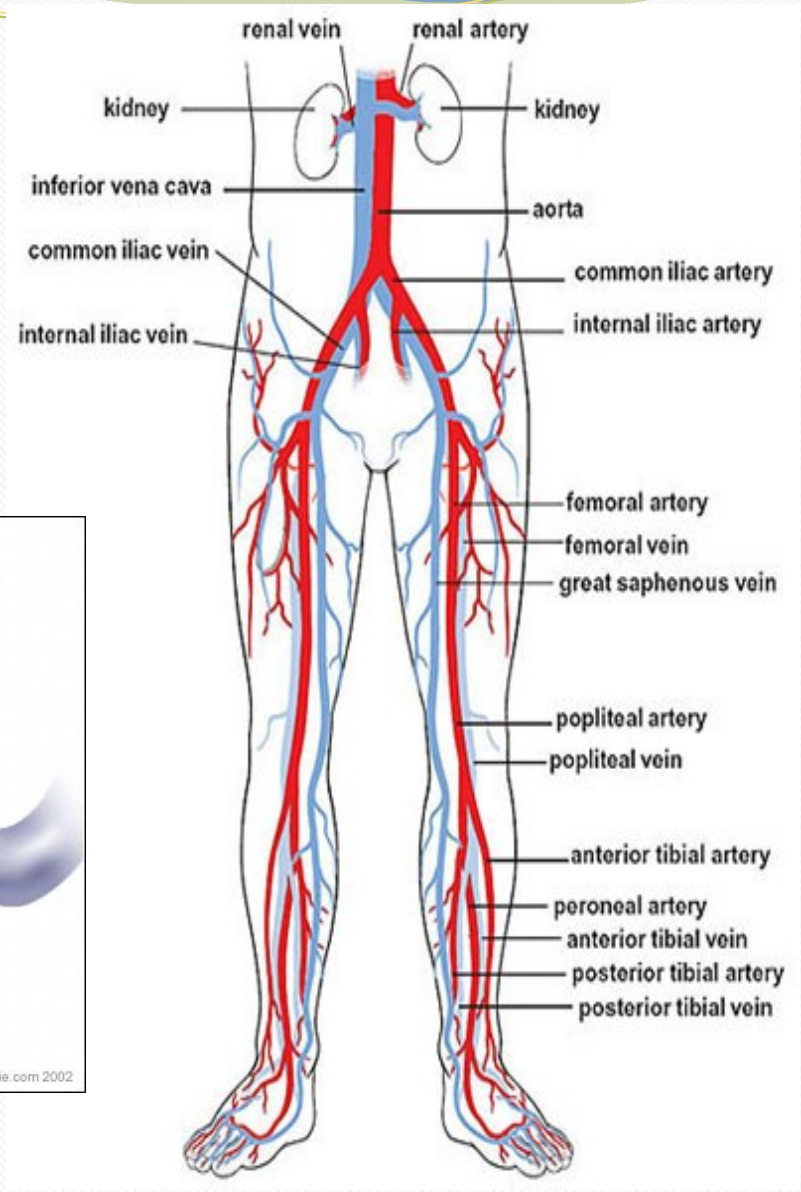
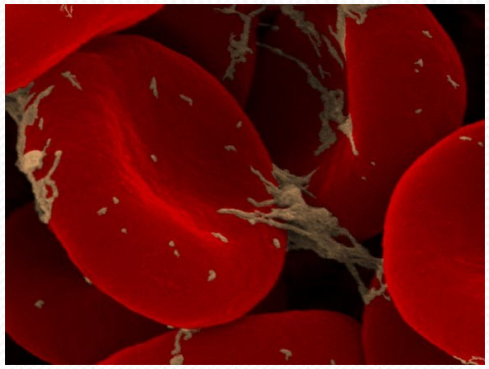

renal vein
renal artery
kidney
kidney
inferior vena cava
aorta
common iliac vein
common iliac artery
internal iliac vein
internal iliac artery
femoral artery
femoral vein
great saphenous vein
popliteal artery
popliteal vein
anterior tibial artery
peroneal artery
anterior tibial vein
posterior tibial artery
posterior tibial vein

THE BLOOD: Red blood cells

- **Oxygen is transported when it binds to the hemoglobin in the red blood cells. Iron and protein are components of hemoglobin.**



- **Each RBC contains approximately 200-250 million hemoglobin molecules. One molecule of hemoglobin can carry 4 molecules of oxygen….this means that one RBC can carry about a billion**

THE BLOOD:

- **Total blood volume: dependent on persons size and training…average for men is 5-6 L and for women is 4-5 L**

- **Composition:**
  1. **55-60% = plasma when properly hydrated**

     -Plasma is usually about 90% water, 7% plasma proteins, 3% nutrients, electrolytes, enzymes, hormones, antibodies, waste products.

  2. **40-50% = RBCs, White blood cells, platelets**

     -99% of these elements are RBCs, 1% WBCs and platelets

THE BLOOD

- Viscosity: how thick and sticky the blood is…

More viscosity = reduced ability to flow

Less viscosity = enhanced ability to flow

Blood has approximately twice the viscosity of water. If plasma volume is down (hematocrit content up) flow may be reduced….usually only happens if plasma

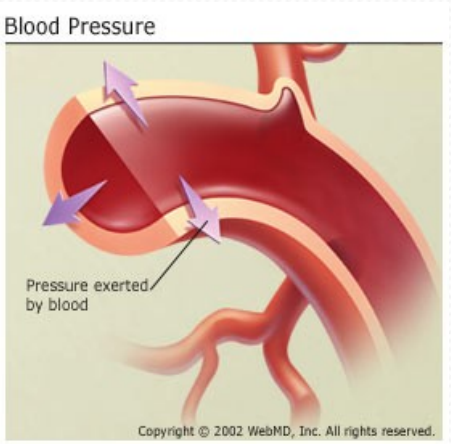
Cardiovascular System Health

A Healthy Heart

- A healthy heart can pump more blood with each pump (stroke volume). This allows it to beat fewer times per minute.
- Although there is a genetic component to resting heart rate (RHR), some of RHR is determined by level of fitness.
- A well conditioning individual may have an RHR as low as 40-60 bpm

BLOOD PRESSURE

Pressure exerted on the wall of the vessels.



- Systolic: highest pressure on walls during a contraction (ventricular contraction)
- Diastolic: lowest amount of pressure in the arteries (between contractions…during chamber filling).

BLOOD PRESSURE

American Heart Association recommendations:

- **Normal: less than 120 and less than 80**
- **Prehypertension: 120–139 or 80–89**
- **High:**
  - Stage 1: 140–159 or 90–99
  - Stage 2: 160 or higher or 100 or higher

HIGH BLOOD PRESSURE

High Blood pressure may indicate plaque build up on

the artery walls.

High Blood pressure makes the heart work harder.

High Blood pressure places stress on the arteries –

- **can cause injury to artery wall where plaque begins to build up**
- **could cause an artery to burst.**

LOW BLOOD PRESSURE

Could cause a person to faint due to lack of

blood flow (O2) to the brain.

Could cause cold extremities due to lack of

blood flow in hands and feet.

Healthy arteries and veins

Cholesterol

A waxy substance found in the fats in your blood. While your body needs cholesterol to continue building healthy cells, having high cholesterol can increase your risk of heart disease.

High cholesterol may cause fatty deposits in blood vessels. Eventually, these deposits make it difficult for enough blood to flow through your arteries increasing the risk of a heart attack or stroke.

Cholesterol

http://www.everydayhealth.com/heartdisease/cholesterol/index.aspx

Cholesterol

Mayo Clinic

Rating	Low Density Lipoprotein (LDL)	High Density Lipoprotein (HDL)	Total Chol.	Triglycerides
Desirable for people at risk of heart disease	Below 100 mg/dL	-	Below 200 mg/dL	
Desirable	100-129 mg/dL	60 mg/dL and above	Below 200 mg/dL	Below 150 mg/dL
Borderline High	130-159 mg/dL	40-49 mg/dL (men) 50-59 mg/dL (women)	200-239 mg/dL	150-199 mg/dL
High	160-189 mg/dL	Below 40 mg/dL (men) Below 50 mg/dL (women)	240 and above mg/dL	200-499 mg/dL

Cholesterol

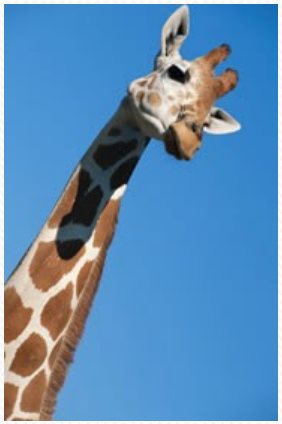
Mayo Clinic

Top five ways to control or reduce cholesterol

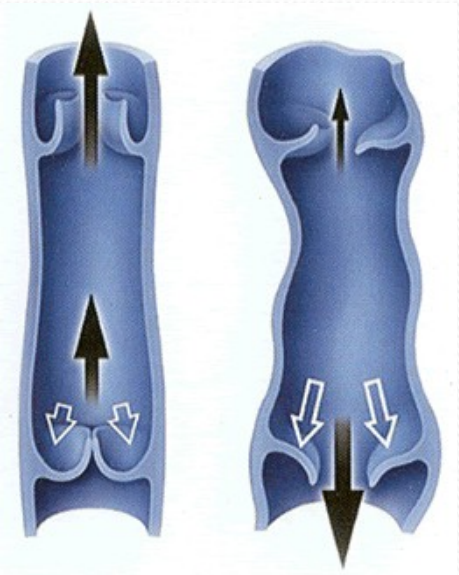
1. Maintain a healthy body weight and body composition.
2. Eat heart healthy food *(low in chol., low in sat. or transfats, high in fruit and veg., whole grains, high in omega-3 fatty acids).*
3. Exercise most days of the week
4. Quit (or do not start) smoking
5. Limit alcohol consumption – less than two drinks a day
6. If lifestyle changes aren’t enough, there are medications (medications aren’t without side

Healthy arteries and veins

Valves in the veins help blood return back to heart:



healthy →



← faulty vein valves

Exercise for Cardiovascular Health

Cardiovascular Exercise

- **ANAEROBIC EXERCISE**: Means “without O2”.

  high intensity work that does not last long – sprinting, jumping, power moves, weight lifting, etc.

- **AEROBIC EXERCISE** “with O2”: lower intensity repetitive exercise involving large muscle movements – jogging, biking, swimming, etc.

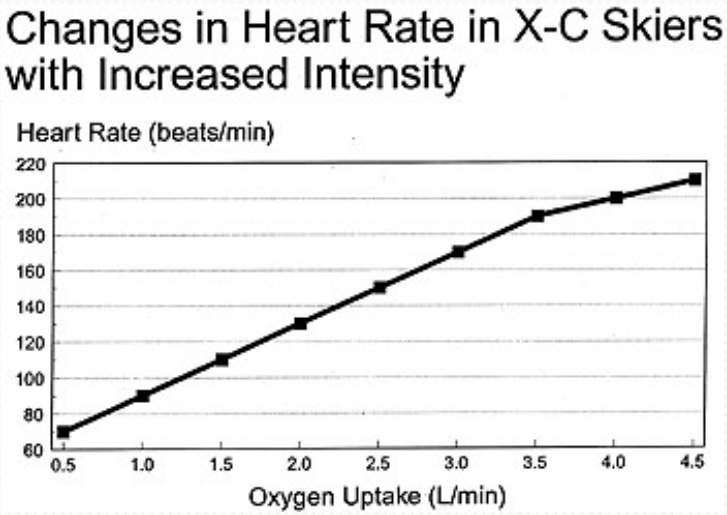
Improving CV Wellness…

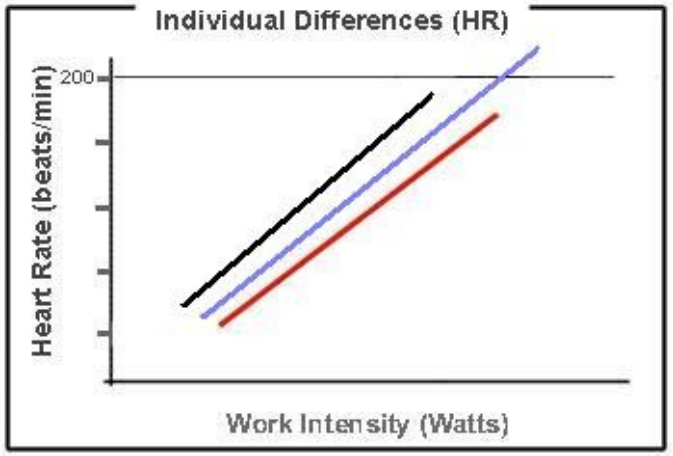
Cardiovascular work

- Frequency = 3X a week or more
- Intensity = Target heart rate zone
- Time = 20 minutes or longer in duration
- Type = Aerobic work ***(running, biking, swimming, dancing, etc.)***

Cardiovascular control **during** exercise

Heart rate increases linearly in proportion to the exercise intensity.





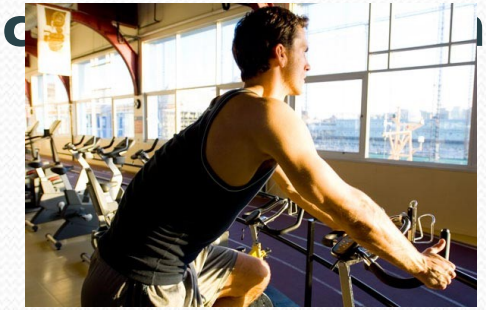
Cardiovascular control

HEART RATE

A good way to get information about the amount of work the heart is doing to meet demands during work. Pulse is usually taken at the radial or carotid arteries or by a monitor.

Determining Intensity

- **There are a variety of ways to determine the appropriate intensity for aerobic work, however…. each method has some shortcomings.**
- **Recognize that the maximal heart rate calculation may vary +/- 10-12 beats for a single given age.**
- **Always make adjustments, especially when the temperature is high or low, medic g taken,**



Determining your target heart rate zone for aerobic exercise

1. Percentage of Maximal Heart Rate

   (220 – age = MHR, multiply by prescribed %)

Intensity recommendations:
Healthy adults, ages 50 and under with no cardiorespiratory considerations

SEDENTARY PERSON:

1. **64-70% Maximal Heart Rate**
2. **12-13 RPE (20 point scale)**
3. **Talk test**

ACTIVE PERSON:

1. **70-94% Maximal Heart Rate**
2. **14-16 RPE (20 point scale)**
3. **Talk test**

Measuring Cardio-respiratory efficiency

- **The most accurate indicator of cardio-respiratory efficiency is to measure the amount of oxygen consumed by the muscles during exercise.**
- **VO_2 = Volume of oxygen consumed**
- **VO_2 Max. = Maximal amount of oxygen consumed the muscles can use.**

- **People who have high efficiency can use between 50-75 ml of oxygen per kg of body weight per minute (50 ml/kg/min.)**

Measure cardio-respiratory efficiency

- Predicting VO2 Max from 1.5 mile run walk time:

(483 / _____) + 3.5 =
_____ml/kg/min.

(time)

- Predicting VO2 Max from 1 mile walk time:

Must factor in weight, gender, age, time and exercise heart rate. (See

Blood distribution

The body has an amazing ability to redistribute blood as needed.

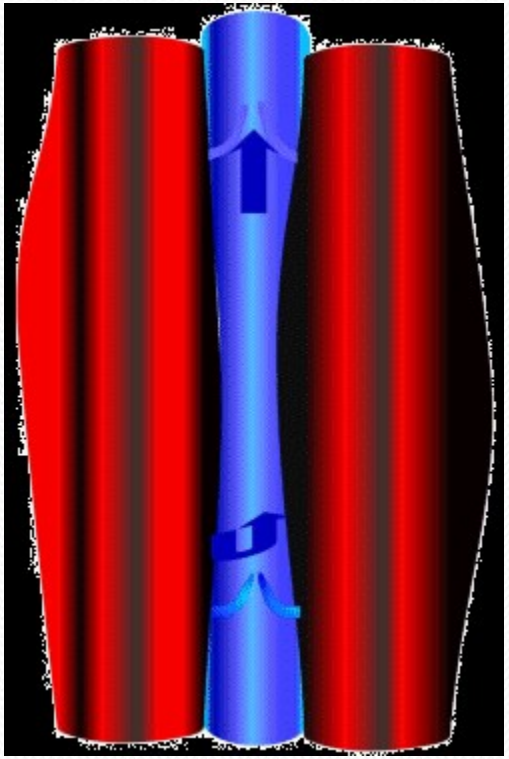
- **After a meal:** **more blood will go to the digestive system.**
- **During heat stress:** **more blood will go to the skin (surface) to help dissipate heat.**
- **At rest:**
  -50% in the liver and kidneys
  -30-35% in other vital organs and tissues
  -15%-20% skeletal muscle
- **Heavy endurance exercise:**
  -20-30% in the liver and kidney and in other vital organs and tissues
  -80% skeletal muscle

Why cool down?

The muscle pump:

When skeletal muscle contracts (especially those in the legs), they squeeze the veins and helps the blood return to the heart.

This is why a cool-down is important….to avoid blood pooling in the legs.



Cardiovascular Exercise Options in the RFC

Aerobic

- **Run on track**
- **Bike (spinner, recumbent, stationary)**
- **Elliptical (upright)**
- **Stepper (upright)**
- **Rowing machine**
- **Arm ergometer**
- **Cardio DVD workouts**

More Anaerobic with some aerobic

- **Racquetball**
- **Basketball**
- **Indoor soccer**
- **Badminton**
- **Volleyball**
- **Etc.**

What questions do you have about cardiovascular health and fitness?

- end